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26. (Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein said guide groove has a upwardly deeper portion for inserting said optical fiber, so as to facilitate the insertion of the lead end of the optical fiber.

REMARKS

Claims 1 to 3 and 5 to 27 are pending.

Claims 1, 15 and 27 are allowed.

Claims 12 and 19 to 25 are rejected.

Claims 2, 3, 5 to 11, 13, 14, 16 to 18 and 26 are objected to.

Section 112 Rejection:

Claim 12 was rejected as being indefinite. Claim 12 has now been canceled.

Claim Objections:

Claims 2, 3, 5, 6, 9 to 14, 16, 17, and 22 to 26 were objected to as having various informalities.

The Examiner suggested various claim amendments to correct the minor informalities in the above claims. The amendments suggested by the Examiner have now been made. Consequently, the various objections to the above claims are believed to be overcome.

Section 103 Rejections:

Claims 19 to 25 were rejected as being obvious over Brown 5,366,657.

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To advance prosecution of the present application, and without concurring in the Examiner's rejection in any way, claims 19 has been amended to set forth the pressure groove being *is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks*, so as to support the optical fiber in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate.

Claims 21, 22, 23 and 24 have been amended to set forth the wiring step or operation including *supporting said optical fiber with a radius of curvature larger than the radius of curvature at which said optical fiber breaks*, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

The Applicants believe the above amendments set forth features of the present invention that are not seen in the cited Brown reference. The Applicants therefore respectfully requests reconsideration and withdrawal of the present obviousness rejections

Conclusion:

For the reasons presented above, all claims are believed to be in condition for allowance. A Notice of Allowance is therefore respectfully requested.

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Should the Examiner feel that a telephone conference would advance prosecution of the present application, he is invited to call the undersigned attorney at the number listed below.

Respectfully submitted,
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VERSION MARKED TO SHOW CHANGES MADE

1. (Previously Amended) An optical fiber wiring apparatus for wiring a wiring substrate, comprising:

a wheel-less wiring head which guides an optical fiber to a lead end thereof along a guide groove through which the optical fiber slides into position on the wiring substrate, the guide groove extending partially along a length of the wiring head and forming an optical fiber path;

an optical fiber feed means which feeds said optical fiber during the wiring operation into said optical fiber path of said wiring head;

an optical fiber contacting means, which brings said optical fiber, which has been guided to said lead end of said wiring head via said optical fiber path, and said wiring substrate into contact, wherein the optical fiber contacting means includes an optical fiber pressing means for pressing said optical fiber against said wiring substrate with a predetermined pressure;

an XY movement means, which moves said wiring substrate and said wiring head relative to one another in the X and Y directions in the state in which said optical fiber at said lead end of said wiring head has been placed in contact with said wiring substrate by said optical fiber contacting means; and

an optical fiber affixing means, which successively affixes, to said wiring substrate, said optical fiber which has been brought into contact with said wiring substrate during movement by said XY movement means,

wherein in the wheel-less wiring head, a pressure groove connected to said guide groove is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, so as to support the optical fiber in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate.

2. (Twice Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein

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said optical fiber within said optical fiber path of said wheel-less wiring head is successively drawn out when the optical fiber at the lead end of said wheel-less wiring head is successively affixed by said optical fiber affixing means, and

said optical fiber feed means feeds said optical fiber stocked in said optical fiber path which successively draws out said optical fiber.

3. (Three Times Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein

at least said [a] lead end of said wheel-less wiring head has a hemispherical shape and the guide groove guides said optical fiber to the hemispherical part,

said pressure groove is formed in said hemispherical part, and

said optical fiber is guided to the lead end of said wheel-less wiring head via said guide groove and said pressure groove.

4. Canceled

5. (Amended) An optical fiber wiring apparatus in accordance with claim 2, wherein

said optical fiber feed means is provided with a deflection detection means for detecting deflection of said optical fiber within said optical fiber path of said wheel-less wiring head or in a path leading to this optical fiber path, and

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a deflection maintaining means for maintaining the deflection within a predetermined range based on detection values of said deflection detection means.

6. (Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein

said optical fiber feed means feeds an amount of optical fiber necessary during various successively executed wirings successively into the optical fiber path of said wheel-less wiring head.

7. (As filed) An optical fiber wiring apparatus in accordance with claim 6, wherein said optical fiber feed means is provided with a reverse rotation prevention means which prevents back feeding of said optical fiber and which conducts drawing out of the optical fiber in the direction of feeding without resistance.

8. (As filed) An optical fiber wiring apparatus in accordance with claim 7, wherein said reverse rotation prevention means is a one-way clutch.

9. (Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein

said optical fiber contacting means is provided with a Z axis actuator which displaces said wheel-less wiring head in a Z axial direction, and displaces said wheel-less wiring head in the direction of said wiring substrate and brings said [an] optical fiber at the lead end of said wheel-less wiring head into contact with said wiring substrate.

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10. (Twice Amended) An optical fiber wiring apparatus in accordance with claim 9, wherein the predetermined pressure with which said optical fiber pressing means presses said optical fiber at said [a] lead end of said wheel-less wiring head against said wiring substrate is within a range of 9.8×10^{-2} (N) (10 gf) - 2.0 N (200 gf).

11. (Amended) An optical fiber wiring apparatus in accordance with claim 1 wherein

at least a part within said optical fiber path of said wheel-less wiring head which comes into contact with said optical fiber comprises a material having a lower coefficient of friction than said optical fiber.

12. Cancelled.

13. (Amended) An optical fiber wiring apparatus in accordance with claim 3, wherein

a Z axial rotation means, which rotates said wheel-less wiring head about the Z axis in accordance with a wiring pattern, and orients said pressure groove of said wheel-less wiring head in a direction in which wiring is to be conducted during the wiring operation, is provided.

14. (Amended) An optical fiber wiring apparatus in accordance with claim 13,

wherein

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said Z axial rotation means is provided with a rotational reference sensor for orienting said pressure groove of said wheel-less wiring head in the direction in which wiring is to be conducted.

15. (As filed) An optical fiber wiring apparatus in accordance with claim 1, wherein an optical fiber cutting means for cutting said optical fiber to a predetermined length is provided.

16. (Amended) An optical fiber wiring apparatus in accordance with claim 15, wherein

said optical fiber cutting means is provided with:

said [an] optical fiber path into which said optical fiber is inserted,

a cutter disposed so as to be capable of movement in a direction crossing said optical fiber path, and

an electromagnetic slider which moves said cutter instantaneously in a direction crossing said optical fiber path.

17. (Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein

said XY movement means moves said wheel-less wiring head and wiring substrate relative to one another so that said wheel-less wiring head is positioned outside said wiring substrate;

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said optical fiber feed means feeds a predetermined length of said optical fiber when said wheel-less wiring head is positioned outside said wiring substrate, and

by means of this, a predetermined length of optical fiber is fed outside said wiring substrate.

18. (As filed) An optical fiber wiring apparatus in accordance with claim 17, wherein a table which supports said wiring substrate and which has drop holes in the vicinity of said wiring substrate support part is provided, and

a predetermined length of optical fiber is fed into said drop holes of said table and a predetermined length of optical fiber is fed out outside of said wiring substrate.

19. (Twice Amended) An optical fiber wiring apparatus which lays optical fibers down on a wiring substrate, comprising:

a manipulator which is disposed in a plane which is approximately parallel to the surface of said wiring substrate in a movable manner, and which conducts the laying operation of the optical fibers on said wiring substrate, the manipulator comprising:

an optical fiber feed means for feeding an optical fiber;

a wheel-less wiring mechanism for wiring, onto said wiring substrate, said optical fiber fed by said optical fiber feed means, wherein the wiring mechanism includes an optical fiber pressing means for pressing said optical fiber against said wiring substrate with a predetermined pressure;

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a Z axial rotation mechanism which rotates about an axis approximately perpendicular to the surface of said wiring substrate and thereby changes the orientation of the wiring of said wiring mechanism; and

an optical fiber cutting means which cuts said optical fiber fed by said optical fiber feed means wherein in the wheel-less wiring mechanism, [said optical fiber is supported by] a pressure groove is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, so as to support the optical fiber in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate [, where said pressure groove is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks].

20. (Previously Amended) An optical fiber wiring apparatus in accordance with claim 19, wherein

said wiring mechanism is disposed so as to be movable in a direction of approach to or separation from said wiring substrate, and said wiring mechanism includes a wiring plunger which presses said optical fiber against said wiring substrate by using said optical fiber pressing means while guiding said optical fiber in a predetermined orientation, and

said optical fiber feed means and said wiring plunger are disposed so as to hold said optical fiber cutting means therebetween in the Z axial direction, and are disposed so as to be simultaneously rotatable by said Z axial rotation means.

21. (Twice Amended) A wiring method which conducts the wiring of an optical fiber onto a wiring substrate, comprising:

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adjusting the feeding of the optical fiber by an optical fiber feed means so that the tension on the optical fiber is within a fixed range;

wiring the optical fiber fed by the optical fiber feed means onto the wiring substrate by a wheel-less wiring mechanism while the optical fiber is guided along a guide groove formed in the wiring mechanism and is pressed against the wiring substrate with a predetermined pressure; and

cutting the optical fiber to a required length for the wiring by an optical fiber cutting means [wherein in the wheel-less wiring mechanism, said optical fiber is supported by a pressure groove in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate, where said pressure groove is connected to said guide groove and is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks] wherein the step of wiring the optical fiber includes supporting said optical fiber with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

22. (Three Times Amended) An optical fiber wiring method which employs an optical fiber wiring apparatus which is provided with a wiring substrate, a wheel-less wiring head which has a guide groove along which an optical fiber is guided, and applies [an] the optical fiber to said wiring substrate with a predetermined pressure, and an optical fiber feed means which feeds stocked optical fiber, which apparatus moves said wiring substrate and said wheel-less wiring head relative to one another in the XY directions and

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conducts wiring operations which form a desired optical fiber wiring pattern on said wiring substrate, comprising;

feeding an optical fiber of predetermined length by said optical fiber feeding means, in a manner unrelated to the wiring, either before or after the wiring operation or both before and after the wiring operation, and thereby producing an optical wiring board having optical fibers of a predetermined length connected to said wiring pattern either before or after said wiring pattern by means of the wiring operation or both before and after said wiring pattern [wherein in the wheel-less wiring head, said optical fiber is supported by a pressure groove in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate, where said pressure groove is connected to said guide groove and is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks] wherein the wiring operation includes supporting said optical fiber with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

23. (Four Times Amended) An optical fiber wiring method which employs an optical fiber wiring apparatus which is provided with a wiring substrate, a wheel-less wiring head which is provided with an optical fiber path which guides an optical fiber to a lead end thereof and which applies said optical fiber guided to said lead end to said wiring substrate with a predetermined pressure, and an optical fiber feeding means which feeds

stocked optical fiber, which apparatus moves said wiring substrate and said wheel-less

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wiring head relative to one another in the XY directions and conducts a wiring operation which forms a predetermined optical fiber wiring pattern on said wiring substrate, comprising:

at the initiation of wiring, moving said wheel-less wiring head to a wiring initiation position, and

in the state in which said optical fiber has been guided to said lead end of said wheel-less wiring head along a guide groove formed in the wheel-less wiring head, pressing said optical fiber against said wiring substrate with said predetermined pressure,

wherein said wheel-less wiring head is moved along said wiring pattern with respect to said wiring substrate, the required optical fiber is fed into said optical fiber path of said wheel-less wiring head by said optical fiber feeding means, and wiring is conducted; and

[in the wheel-less wiring head, said optical fiber is supported by a pressure groove in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate, where said pressure groove is connected to said guide groove and is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks] wherein the step of pressing the optical fiber against said wiring substrate includes supporting said optical fiber with a radius of curvature at which said optical fiber breaks, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

24. (Three Times Amended) An optical fiber wiring method in which an optical

fiber is laid on a wiring substrate by a wheel-less wiring head, at least a lead end of which
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is formed with a [spherical] curved surface, which has formed in a side surface part thereof a guide groove which guides said [an] optical fiber to said spherical surface part, and which has a pressure groove which extends from said guide groove to the bottom [top] part of said spherical surface part, comprising;

at the initiation of wiring, moving said wheel-less wiring head to a wiring initiation position:

fitting an optical fiber into said pressure groove;

pressing the optical fiber against said wiring substrate with a predetermined pressure; and

moving said wheel-less wiring head along said wiring pattern with respect to said wiring substrate to thereby conduct said wiring wherein [said pressure groove is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks] the step of pressing the optical fiber against said wiring substrate includes supporting said optical fiber via said pressure groove with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, in a state which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

25. (Amended) An optical fiber wiring method in accordance with claim 24, wherein

when a wiring pattern to be wired is a curved pattern, said pressure groove of said wheel-less wiring head is oriented in a direction at tangent to said wiring pattern.

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26. (Amended) An optical fiber wiring apparatus in accordance with claim 1, wherein said guide groove has a upwardly deeper portion for inserting said optical fiber, so as to facilitate the insertion of the lead end of the optical fiber.

27. (Previously Added) An optical fiber wiring apparatus in accordance with claim 1, wherein said pressure groove is formed so as to become narrower and shallower as it approaches the lead end of the wheel-less wiring head.